excerpts From ASARCO report

151665

Process Waste: This is a generic term that refers to all of the metal refining process waste materials placed on the site by ASARCO. These include: slag, refractory brick, furnace scale, red building brick, black spongiform clinker, metal scrap, pipes, hoses, carbon electrodes, ceramic retorts, formed concrete (including troughs, boxes, bins, and pipes), and residues (white, blue-grey, and mustard-yellow pasty granular sludges). Of these materials, the primary sources of contaminants are slag and residues. These are discussed in Section 2.2.2 of this report. Brief descriptions are provided below:

Slag: Hard, vitreous waste; typically with concoidal fracture; found in both massive and granular form; massive form usually dark grey to black and commonly orange or rust stained; granular form black or deep red.

Residues: Varicolored pasty, sludge-like materials; often contain granular material.

Reworked Fill Layer: This is primarily a surficial layer which contains soil or hydraulic fill mixed with all of the process waste materials listed above. It represents a reworked surface created after ASARCO sold the site in 1979.

CDF Slag: Process wastes found beneath the surficial silty-clay in the CDF. This is equivalent to the reworked fill layer present at the surface outside of the CDF.

2.0 DESCRIPTION OF INVESTIGATION ACTIVITIES

2.1 Site Preparation

The soil borings, monitoring wells, and test pits were installed between September 12 through 26, 2002. Wells, borings, and test pits were installed at the approximate locations proposed with modifications resulting from equipment accessibility. The actual locations and the roadways cleared are illustrated on Figure 3.

Due to the drought conditions which prevailed throughout the summer, it was not necessary to make raised roadways and road building consisted only of brush clearing and rough grading. At the southeast corner of the new slag yard, where the road to locations PB-31, AMW-8 and AMW-9 was built, it was necessary to construct a ramp out of available hydraulic fill to allow drilling equipment to step down from the slag.

non-responsive

maximum extent of slag as mapped on the basis of photographs. However, this area has been extensively filled and regraded since the photographs documenting the last stages of slag filling were taken. As a result, approximately 8 feet of process wastes were found overlying natural materials at this location. This material was derived from ASARCO's operations but was placed at this location by a subsequent owner of the site.

2. The area between the Eastman facility and Crane's Creek. In the 1940 aerial, this area is occupied by a large pond or lagoon. In the 1951 aerial it has been covered with hydraulic fill material. The photographs give no indication of slag filling. Wells AMW-10 and OT-1A installed within this area both encountered slag to depths of approximately 12.5 feet. Neither well encountered hydraulic fill. Based on the observations made in this investigation and the earlier review of aerial photographs, the pond in this area in 1940 was filled with slag and covered with hydraulic fill by 1951. The hydraulic fill was subsequently removed[1].

3. AMW-5 area. On the north side of the northern hydraulic fill cell, process waste was found to extend approximately 100 feet further to the east than originally mapped. A narrow band of industrial fill, including slag and retorts was found to extend between the dike and Crane's Creek to within about 100 feet of the Arthur Kill. This material was heavily overgrown. Based on the materials encountered in AMW-5 (see log in Appendix C) and a re-evaluation of aerial photo evidence, this material was placed between two distinct episodes of hydraulic filling during the period of 1959 to 1970.

These conditions are all illustrated on Figure 4.

2.2.2 Process Waste Composition

The most abundant of the process wastes are granular slag and massive slag. One or both of these textural variations were observed at nearly all locations where waste materials were identified. The granular slag occurs as either red or black color variants. These were found in discreet accumulations of either red or black, in mixed accumulations, and in banded stratified accumulations. The massive slag is dark grey to black and typically has a rusty-orange staining on the fractures.

---

[1]. See RIW: Section 2.2.4, Figure 5, and Appendix C.

1) The flow of water through the spillway results in the lateral spreading of process wastes and surficial materials;

2) Filling the CDF basin exerts a tremendous hydraulic head on the groundwater system accelerating flow; and,

3) Saline dredge water provides a large influx of major ions altering the groundwater chemistry.

The As found in samples PB-20, -21, -30, and -31 is not associated with high concentrations of other metals or with visibly apparent accumulations of slag and is not derived from the hydraulic fill. The As in these samples is the result of precipitation of As dissolved in groundwater migrating away from the slag yard. Evidence from groundwater supports this theory.

Monitoring wells located to the east (downgradient) of the slag yard contained only As at concentrations exceeding the GWQS. Groundwater samples from the upgradient slag yard wells (SE-120, SE-122, & SE-123R) contained Sb, As, Cd, Pb, Ni, and Se at concentrations exceeding the GWQS.

Results from monitoring well AMW-7 are particularly instructive. Despite the presence of elevated concentrations of Sb, As, Cu, Pb, and Zn in the soil surrounding the well, groundwater samples contained only As at concentrations in excess of the GWQS. The limited effect that the other metals on the groundwater is a reflection of ability of the soils to adsorb metals. The fact that As remains a significant groundwater contaminant in this same area is due to its chemical and physical characteristics[8]. The highest on-site occurences of As are found in the fine-grained residues (see Table 1A). The As in the residues is most likely in the forms of elemental As, arsenic pentoxide (As_2O_5), and arsenic trioxide (As_2O_3)[8]. These oxides are soluble in water, acids, alcohols, and alkalis. Cold and hot water solubilities for As_2O_3 are 3.7 and 10.14 grams/cc respectively, while those of As_2O_5 are 150 and 76.7 grams/cc. The solubility values are much higher than those given for any of the other metals found in the slag, the soil, or in the groundwater.

The possible effect that the addition of saline water to the groundwater system through the CDF was discussed above. However, other high concentration sources

---

[8]. Information on the physical constants and characteristics of arsenic is from: CRC Handbook of Chemistry and Physics, 74th Edition, 1993.

[8]. See: Sax, N. Irving, and Lewis, Richard L., editors, Hawley's Condensed Chemical Dictionary, 11th Edition, Van Nostrand Reinhold Company, 1987.